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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,951	02/18/2004	J. Rodney Walton	040235	4445

23696 7590 10/18/2010
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EXAMINER	
ALIA, CURTIS A	
ART UNIT	**PAPER NUMBER**
2474	
NOTIFICATION DATE	**DELIVERY MODE**
10/18/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/781,951	Applicant(s) WALTON ET AL.	
	Examiner Curtis A. Alia	Art Unit 2474	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 July 2010*.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23 and 63* is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) *1-23 and 63* is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a)☐ All b)☐ Some * c)☐ None of:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. In view of the Appeal Brief filed on 23 July 2010, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

/Aung S. Moe/

Supervisory Patent Examiner, Art Unit 2474.

Double Patenting

2. Claims 1-23 and 63 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-8, 10-24 and 65 of copending

Application No. 10/794,918. Although the conflicting claims are not identical, they are not patentably distinct from each other because "data packet" and "protocol data unit (PDU)" are well known in the art to be equivalent data structures and are interchangeable.

Instant Claims	Conflicting Claims
1. A method of transmitting data from a transmitting entity to a receiving entity in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising: processing a data packet to obtain a block of data symbols; demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the data packet, a plurality of sequences of pilot and data symbols for the plurality of subbands; and performing spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.	1. A method of transmitting data from a transmitting entity to a receiving entity in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising: processing a protocol data unit (PDU) to obtain a block of data symbols; demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands; and performing spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.
2. The method of claim 1, wherein the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband.	2. The method of claim 1, wherein the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband.
3. The method of claim 2, wherein a plurality of different steering vectors is used for the plurality of subbands.	3. The method of claim 2, wherein a plurality of different steering vectors is used for the plurality of subbands.
4. The method of claim 2, wherein the one steering vector used for the spatial processing of each subband is unknown to the receiving entity.	4. The method of claim 2, wherein the one steering vector used for the spatial processing of each subband is unknown to the receiving entity.
5. The method of claim 1, wherein the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband.	5. The method of claim 1, wherein the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband.
6. The method of claim 1, wherein one pilot or data symbol is sent on each subband in each symbol period, and wherein the pilot and data symbols for each subband is spatially processed with a different steering vector for each symbol period.	6. The method of claim 1, wherein one pilot or data symbol is sent on each subband in each symbol period, and wherein the pilot and data symbols for each subband is spatially processed with a different steering vector for each symbol period.
7. The method of claim 1, wherein the at least one steering vector used for spatial processing for each subband is known only to the transmitting entity and the receiving entity.	7. The method of claim 1, wherein the at least one steering vector used for spatial processing for each subband is known only to the transmitting entity and the receiving entity.
8. The method of claim 1, wherein the spatial processing with the at least one steering vector for each subband is performed only on data symbols.	8. The method of claim 1, wherein the spatial processing with the at least one steering vector for each subband is performed only on data symbols.

9. The method of claim 1, wherein the processing a data packet includes encoding the data packet in accordance with a coding scheme to obtain coded data, interleaving the coded data to obtain interleaved data, and symbol mapping the interleaved data in accordance with a modulation scheme to obtain the block of data symbols.	10. The method of claim 1, wherein the PDU processing includes encoding the PDU in accordance with a coding scheme to obtain coded data, interleaving the coded data to obtain interleaved data, and symbol mapping the interleaved data in accordance with a modulation scheme to obtain the block of data symbols.
10. The method of claim 1, further comprising: selecting the at least one steering vector for each subband from among a set of L steering vectors, where L is an integer greater than one.	11. The method of claim 1, further comprising: selecting the at least one steering vector for each subband from among a set of L steering vectors, where L is an integer greater than one.
11. The method of claim 10, wherein the L steering vectors are such that any pair of steering vectors among the L steering vectors have low correlation.	12. The method of claim 11, wherein the L steering vectors are such that any pair of steering vectors among the L steering vectors have low correlation.
12. The method of claim 6, further comprising: selecting a steering vector for each subband in each symbol period from among a set of L steering vectors, where L is an integer greater than one.	13. The method of claim 6, further comprising: selecting a steering vector for each subband in each symbol period from among a set of L steering vectors, where L is an integer greater than one.
13. The method of claim 1, wherein each steering vector includes T elements having same magnitude but different phases, where T is the number of transmit antennas at the transmitting entity and is an integer greater than one.	14. The method of claim 1, wherein each steering vector includes T elements having same magnitude but different phases, where T is the number of transmit antennas at the transmitting entity and is an integer greater than one.
14. An apparatus in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising: a data processor operative to process a data packet to obtain a block of data symbols; a demultiplexer operative to demultiplex pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the data packet, a plurality of sequences of pilot and data symbols for the plurality of subbands; and a spatial processor operative to perform spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.	15. An apparatus in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising: a data processor operative to process a protocol data unit (PDU) to obtain a block of data symbols; a demultiplexer operative to demultiplex pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands; and a spatial processor operative to perform spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.
15. The apparatus of claim 14, wherein the spatial processor is operative to spatially process the pilot and data symbols for each subband with one steering vector selected for the subband.	16. The apparatus of claim 15, wherein the spatial processor is operative to spatially process the pilot and data symbols for each subband with one steering vector selected for the subband.
16. The apparatus of claim 14, wherein the spatial processor is operative to spatially process the pilot and data symbols for each subband with at least two steering vectors selected for the subband.	17. The apparatus of claim 15, wherein the spatial processor is operative to spatially process the pilot and data symbols for each subband with at least two steering vectors selected for the subband.
17. The apparatus of claim 16, wherein the at least two steering vectors for each subband are known	18. The apparatus of claim 17, wherein the at least two steering vectors for each subband are known

only to a transmitting entity and a receiving entity for the data packet.	only to a transmitting entity and a receiving entity for the PDU.
18. The apparatus of claim 14, wherein each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the data packet and is an integer greater than one.	19. The apparatus of claim 15, wherein each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the PDU and is an integer greater than one.
19. An apparatus in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising: means for processing a data packet to obtain a block of data symbols; means for demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the data packet, a plurality of sequences of pilot and data symbols for the plurality of subbands; and means for performing spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.	20. An apparatus in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising: means for processing a protocol data unit (PDU) to obtain a block of data symbols; means for demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands; and means for performing spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.
20. The apparatus of claim 19, wherein the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband.	21. The apparatus of claim 20, wherein the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband.
21. The apparatus of claim 19, wherein the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband.	22. The apparatus of claim 20, wherein the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband.
22. The apparatus of claim 21, wherein the at least two steering vectors for each subband are known only to a transmitting entity and a receiving entity for the data packet.	23. The apparatus of claim 22, wherein the at least two steering vectors for each subband are known only to a transmitting entity and a receiving entity for the PDU.
23. The apparatus of claim 19, wherein each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the data packet and is an integer greater than one.	24. The apparatus of claim 20, wherein each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the PDU and is an integer greater than one.
63. A memory unit for processing data for transmission from transmitting data from a transmitting entity to a receiving entity in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM) comprising a memory, the memory having instructions stored thereon, the instructions being executable by one or more processors and the instructions comprising: instructions for processing a data packet to obtain a block of data symbols; instructions for demultiplexing pilot symbols and the block of data	65. A memory unit for processing data for transmission from transmitting data from a transmitting entity to a receiving entity in a wireless multi-antenna communication system utilizing orthogonal frequency division multiplexing (OFDM) comprising a memory, the memory having instructions stored thereon, the instructions being executable by one or more processors and the instructions comprising: instructions for processing a protocol data unit (PDU) to obtain a block of data symbols; instructions for demultiplexing pilot symbols and the

symbols onto a plurality of subbands to obtain, for the data packet, a plurality of sequences of pilot and data symbols for the plurality of subbands; and instructions for performing spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.	block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands; and instructions for performing spatial processing on at least one of the pilot and data symbols for each subband with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 19 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. The claim limitation "means for processing/means for demultiplexing/means for performing" uses the phrase "means for" or "step for", but it is modified by some structure, material, or acts recited in the claim. It is unclear whether the recited structure, material, or acts are sufficient for performing the claimed function which would preclude application of 35 U.S.C. 112, sixth paragraph, because the claim limitations are modified by some structure.

If applicant wishes to have the claim limitation treated under 35 U.S.C. 112, sixth paragraph, applicant is required to amend the claim so that the phrase "means for" or "step for" is clearly **not** modified by sufficient structure, material, or acts for performing the claimed function.

If applicant does **not** wish to have the claim limitation treated under 35 U.S.C. 112, sixth paragraph, applicant is required to amend the claim so that it will clearly not be a means (or step) plus function limitation (e.g., deleting the phrase “means for” or “step for”).

Assuming Applicant intended to invoke 35 U.S.C. 112, sixth paragraph, it is unclear to one of ordinary skill in the art whether the recited structure, material, or acts in the claim are sufficient for performing the claimed function. Since the claims are directed to computer-implemented means plus function subject matter, merely referencing to a general purpose computer with appropriate programming without providing any detailed explanation of the appropriate programming, the written description of the specification discloses no corresponding algorithm or simply reciting software without providing some detail about the means to accomplish the function, would not be an adequate disclosure of the corresponding structure to satisfy the requirement of 35 U.S.C. 112, second paragraph, even when one of ordinary skill in the art is capable of writing the software to convert a general purpose computer to a special purpose computer to perform the claimed function.

Claim Rejections - 35 USC § 103

6. Claims 1, 14, 19 and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace et al. (newly cited US 6,473,467) in view of Trikkonen (previously cited US 2004/0002364).

Regarding claim 1, Wallace discloses a method of transmitting data from a transmitting entity to a receiving entity in a wireless multi-antenna communication system (see column 4,

lines 28+, system including a transmitter in a MIMO system) utilizing orthogonal frequency division multiplexing (OFDM) (see column 10, lines 30+, utilizing an OFDM technology), comprising:

processing a data packet to obtain a block of data symbols (see column 5, lines 5+, many different types of data are supplied to the transmitter for transmission to a receiver, including packet data);

demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the data packet, a plurality of sequences of pilot and data symbols for the plurality of subbands (see column 19, lines 24+, the aggregate input data stream is demultiplexed into a number of channel data streams, column 20, lines 15+, data streams are encoded into blocks of groups of symbols); and

performing spatial processing on at least one of the pilot and data symbols for each subband (see column 21, lines 65+, spatially processing the sub-channel (sub band) data streams for transmission on the multiple antennas).

Wallace does not explicitly teach that the special processing is performed with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Trikkonen. In particular, Trikkonen teaches that the special processing is performed with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands (see paragraphs 141-155, randomizing the spatial processing of the different channels (being

each subchannel/subband), beamforming is used to steer the radio signal from the antennas (paragraph 147), and sent across multiple antennas (plurality of effective SISO = MIMO)).

In view of the above, having the method of Wallace, then given the well-established teaching of Trikkonen, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace as taught by Trikkonen, since Trikkonen stated that various systems.

Regarding claim 14, Wallace discloses an apparatus in a wireless multi-antenna communication system (see column 4, lines 28+, system including a transmitter in a MIMO system) utilizing orthogonal frequency division multiplexing (OFDM) (see column 10, lines 30+, utilizing an OFDM technology), comprising

a data processor operative to process a PDU to obtain a block of data symbols (see column 5, lines 5+, many different types of data are supplied to the transmitter for transmission to a receiver, including packet data),

a demultiplexer operative to demultiplex pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands (see column 19, lines 24+, the aggregate input data stream is demultiplexed into a number of channel data streams, column 20, lines 15+, data streams are encoded into blocks of groups of symbols) and

a spatial processor operative to perform spatial processing on at least one of the pilot and data symbols for the subband (see column 21, lines 65+, spatially processing the sub-channel (sub band) data streams for transmission on the multiple antennas).

Wallace does not explicitly teach that at least one steering vector is selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Trikkonen. In particular, Trikkonen teaches that at least one steering vector is selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands (see paragraphs 141-155, randomizing the spatial processing of the different channels (being each subchannel/subband), beamforming is used to steer the radio signal from the antennas (paragraph 147), and sent across multiple antennas (plurality of effective SISO = MIMO)).

In view of the above, having the apparatus of Wallace, then given the well-established teaching of Trikkonen, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the apparatus of Wallace as taught by Trikkonen, since Trikkonen stated that various systems.

Regarding claim 19, Wallace discloses an apparatus in a wireless multi-antenna communication system (see column 4, lines 28+, system including a transmitter in a MIMO system) utilizing orthogonal frequency division multiplexing (OFDM) (see column 10, lines 30+, utilizing an OFDM technology), comprising

means for processing a data packet to obtain a block of data symbols (see column 5, lines 5+, many different types of data are supplied to the transmitter for transmission to a receiver, including packet data),

means for demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands (see column 19, lines 24+, the aggregate input data stream is demultiplexed into a number of channel data streams, column 20, lines 15+, data streams are encoded into blocks of groups of symbols), and

means for performing spatial processing on at least one of the pilot and data symbols for each subband (see column 21, lines 65+, spatially processing the sub-channel (sub band) data streams for transmission on the multiple antennas).

Wallace does not explicitly teach that at least one steering vector is selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands (see paragraphs 141-155, the channels are randomized, beamforming is used to steer the radio signal from the antennas.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Trikkonen. In particular, Trikkonen teaches that the special processing is performed with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands (see paragraphs 141-155, randomizing the spatial processing of the different channels (being each subchannel/subband), beamforming is used to steer the radio signal from the antennas (paragraph 147), and sent across multiple antennas (plurality of effective SISO = MIMO)).

In view of the above, having the apparatus of Wallace, then given the well-established teaching of Trikkonen, it would have been obvious to a person having ordinary skill in the art at

the time of the invention to modify the apparatus of Wallace as taught by Trikkonen, since Trikkonen stated that various systems.

Regarding claim 63, Trikkonen discloses a software storage apparatus for processing data for transmission from a transmitting entity to a receiving entity in a wireless multi-antenna communication system (see column 4, lines 28+, system including a transmitter in a MIMO system) utilizing orthogonal frequency division multiplexing (OFDM) (see column 10, lines 30+, utilizing an OFDM technology) comprising

a memory, the memory having instructions stored thereon, the instructions being executable by one or more processors (see column 28, lines 58+, combination of hardware and software used to perform the functions) and the instructions comprising

instructions for processing a data packet to obtain a block of data symbols (see column 5, lines 5+, many different types of data are supplied to the transmitter for transmission to a receiver, including packet data),

instructions for demultiplexing pilot symbols and the block of data symbols onto a plurality of subbands to obtain, for the PDU, a plurality of sequences of pilot and data symbols for the plurality of subbands (see column 19, lines 24+, the aggregate input data stream is demultiplexed into a number of channel data streams, column 20, lines 15+, data streams are encoded into blocks of groups of symbols), and

instructions for performing spatial processing on at least one of the pilot and data symbols for the subband (see column 21, lines 65+, spatially processing the sub-channel (sub band) data streams for transmission on the multiple antennas).

Wallace does not explicitly teach that at least one steering vector is selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands .

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Trikkonen. In particular, Trikkonen teaches that the special processing is performed with at least one steering vector selected for the subband, the spatial processing randomizing a plurality of effective single-input single-output (SISO) channels observed across the plurality of subbands (see paragraphs 141-155, randomizing the spatial processing of the different channels (being each subchannel/subband), beamforming is used to steer the radio signal from the antennas (paragraph 147), and sent across multiple antennas (plurality of effective SISO = MIMO)).

In view of the above, having the device of Wallace, then given the well-established teaching of Trikkonen, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the device of Wallace as taught by Trikkonen, since Trikkonen stated that various systems.

7. Claims 2-3, 15 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claims 1, 14 and 19 above, and further in view of Onggosanusi (previously cited US 2002/0114269).

Regarding claim 2, Wallace and Trikkonen do not explicitly teach that the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Onggosanusi. In particular, Onggosanusi teaches that the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband (see paragraphs 41-43, each subchannel is controlled through selection of values for a beamforming vector and frequency index, thus each subband is examined and controlled via beamforming (spatial processing), where each sub-channel is associated with a specific frequency index and beamformer weight).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Onggosanusi, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Onggosanusi, since Onggosanusi stated that reducing the computational resources required for maintaining a spatially distinct beam-forming transmissions is possible.

Regarding claim 3, Wallace and Trikkonen do not explicitly teach that a plurality of different steering vectors is used for the plurality of subbands.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Onggosanusi. In particular, Onggosanusi teaches that a plurality of different steering vectors are used for the plurality of subbands (see paragraph 43, each sub-channel is associated with a specific frequency index and beamformer weight, thus a beamforming weight/vector is used for a particular subband, therefore the plurality of subbands has a plurality of different steering vectors).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Onggosanusi, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Onggosanusi, since Onggosanusi stated that reducing the computational resources required for maintaining a spatially distinct beam-forming transmissions is possible.

Regarding claim 15, Wallace and Trikkonen do not explicitly teach that the spatial processor is operative to spatially process the pilot and data symbols for each subband with one steering vector selected for the subband.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Onggosanusi. In particular, Onggosanusi teaches that the spatial processor is operative to spatially process the pilot and data symbols for each subband with one steering vector selected for the subband (see paragraphs 41-43, each subchannel is controlled through selection of values for a beamforming vector and frequency index, thus each subband is examined and controlled via beamforming (spatial processing), where each sub-channel is associated with a specific frequency index and beamformer weight).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Onggosanusi, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Onggosanusi, since Onggosanusi stated that reducing the computational resources required for maintaining a spatially distinct beam-forming transmissions is possible.

Regarding claim 20, Wallace and Trikkonen do not explicitly teach that the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Onggosanusi. In particular, Onggosanusi teaches that the pilot and data symbols for each subband is spatially processed with one steering vector selected for the subband (see paragraph 43, each sub-channel is associated with a specific frequency index and beamformer weight, thus a beamforming weight/vector is used for a particular subband).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Onggosanusi, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Onggosanusi, since Onggosanusi stated that reducing the computational resources required for maintaining a spatially distinct beam-forming transmissions is possible.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claim 2 above, and further in view of Honig (previously cited US 6,956,897).

Regarding claim 4, Wallace and Trikkonen do not explicitly teach that the one steering vector used for spatial processing for each subband is unknown to the receiving entity.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Honig. In particular, Honig teaches that the one steering vector used for spatial processing for

each subband is unknown to the receiving entity (see column 3, lines 43+, the receiver generates an "estimated" steering vector, as opposed to the given steering vector being the steering vector known to the receiver).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Honig, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Honig, since Honig stated in column 1, lines 66+ that faster tracking and convergence with less training samples can be achieved.

9. Claims 5, 16 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claims 1, 15 and 20 above, and further in view of Kim et al. (previously cited US 6,937,189).

Regarding claim 5, Wallace and Trikkonen do not explicitly teach that the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Kim. In particular, Kim teaches that the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband (see column 2, lines 34+, beamforming algorithm is chosen based on whether the data is a pilot data symbol or a non pilot data symbol, thus a different steering vector is obtained on a pilot data symbol than a data symbol).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Kim, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Kim, since Kim stated that the speed of optimal value convergence is increased.

Regarding claim 16, Wallace and Trikkonen do not explicitly teach that the spatial processor is operative to spatially process the pilot and data symbols for each subband with at least two steering vectors selected for the subband.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Kim. In particular, Kim teaches that the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband (see column 2, lines 34+, beamforming algorithm is chosen based on whether the data is a pilot data symbol or a non pilot data symbol, thus a different steering vector is obtained on a pilot data symbol than a data symbol).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Kim, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Kim, since Kim stated the speed of optimal value convergence is increased.

Regarding claim 21, Wallace and Trikkonen do not explicitly teach that the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Kim. In particular, Kim teaches that the pilot and data symbols for each subband is spatially processed with at least two steering vectors selected for the subband (see column 2, lines 34+, beamforming algorithm is chosen based on whether the data is a pilot data symbol or a non pilot data symbol, thus a different steering vector is obtained on a pilot data symbol than a data symbol).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Kim, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Kim, since Kim stated the speed of optimal value convergence is increased.

10. Claims 6, 10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claim 1, and further in view of Walton et al. (previously cited US 2003/0235147, published 25 December 2003).

Regarding claim 6, Wallace and Trikkonen do not explicitly teach that one pilot or data symbol is sent on each subband in each symbol period, and wherein the pilot and data symbols for each subband is spatially processed with a different steering vector for each symbol period.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Walton. In particular, Walton teaches that one pilot or data symbol is sent on each subband in each symbol period (see paragraph 110, each multiplier multiplies each symbol in its vector with its Walsh function to transmit two symbols per two consecutive symbol periods, thus averaging

to one symbol per symbol period) and wherein the pilot and data symbols for each subband is spatially processed with a different steering vector for each symbol period (see paragraph 95, for each vector, the symbols are transmitted in different symbol periods on different antennas).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Walton, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method of Wallace and Trikkonen as taught by Walton, since Walton stated that transmission diversity can be achieved with criteria such as channel conditions and receiver capabilities.

Regarding claim 10, Wallace and Trikkonen do not explicitly teach selecting the at least one steering vector for each subband from among a set of L steering vectors, where L is an integer greater than one.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Walton. In particular, Walton teaches selecting the at least one steering vector for each subband from among a set of L steering vectors, where L is an integer greater than one (see paragraph 95, two vectors are generated).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Walton, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method of Wallace and Trikkonen as taught by Walton, since Walton stated that transmission diversity can be achieved with criteria such as channel conditions and receiver capabilities.

Regarding claim 12, Wallace and Trikkonen do not explicitly teach selecting a steering vector for each subband in each symbol period from among a set of L steering vectors, where L is an integer greater than one.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Walton. In particular, Walton teaches selecting a steering vector for each subband in each symbol period from among a set of L steering vectors, where L is an integer greater than one (see paragraphs 95 and 110, multiple steering vectors, where each steering vector belongs to a subband and a symbol period).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Walton, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the method of Wallace and Trikkonen as taught by Walton, since Walton stated that transmission diversity can be achieved with criteria such as channel conditions and receiver capabilities.

11. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claim 1 above, and further in view of Ketchum (previously cited US 2003/0108117).

Regarding claim 7, Wallace and Trikkonen does not explicitly teach that the at least one steering vector used for spatial processing for each subband is known only to the transmitting entity and the receiving entity.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Ketchum. In particular, Ketchum teaches that the at least one steering vector used for spatial processing for each subband is known only to the transmitting entity and the receiving entity (see paragraph 12, the steering vector known to the transmitting station is sent to the receiving station, therefore the transmitting station and the receiving station both know the steering vectors).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Ketchum, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Ketchum, since Ketchum stated in paragraph 10 that high throughput can be achieved without individually coding each frequency bin.

12. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claim 1, and further in view of Jasper et al. (previously cited US 6,441,786).

Regarding claim 8, Wallace and Trikkonen do not explicitly teach that the spatial processing with the at least one steering vector for each subband is performed only on data symbols.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Jasper. In particular, Jasper teaches that the spatial processing with the at least one steering

vector for each subband is performed only on data symbols (see column 9, lines 65+, steering vector is calculated for each data symbol).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Jasper, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Jasper, since Jasper stated that the effects of interference and noise can be limited.

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claim 1, and further in view of Shattil (previously cited US 2004/0086027).

Regarding claim 9, Wallace and Trikkonen do not explicitly teach encoding the PDU in accordance with a coding scheme to obtain coded data, interleaving the coded data to obtain interleaved data, and symbol mapping the interleaved data in accordance with a modulation scheme to obtain the block of data symbols.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Shattil. In particular, Shattil teaches encoding the PDU in accordance with a coding scheme to obtain coded data, interleaving the coded data to obtain interleaved data, and symbol mapping the interleaved data in accordance with a modulation scheme to obtain the block of data symbols (see paragraph 88, data is encoded, then the coded data is interleaved by an interleaver, then the interleaved data is mapped into data symbols in a block).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Shattil, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Shattil, since Shattil stated in paragraph 32 that greater bandwidth efficiency can be achieved.

14. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen and Walton as applied to claim 10, and further in view of Hudson et al. (previously cited US 6,477,161).

Regarding claim 11, Wallace, Trikkonen and Walton do not explicitly teach that the L steering vectors are such that any pair of steering vectors among the L steering vectors has low correlation.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Hudson. In particular, Hudson teaches that the L steering vectors are such that any pair of steering vectors among the L steering vectors have low correlation (see column 6, lines 3-12, correlation between vectors is either nonexistent (orthogonal) or very small).

In view of the above, having the method of Wallace, Trikkonen and Walton, then given the well-established teaching of Hudson, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace, Trikkonen and Walton as taught by Hudson, since Hudson stated that symbol detection can be improved.

15. Claims 13, 18, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen as applied to claims 1, 14 and 19, and further in view of Lewis (previously cited US 2004/0102157).

Regarding claim 13, Wallace and Trikkonen do not explicitly teach that each steering vector includes T elements having same magnitude but different phases, where T is the number of transmit antennas at the transmitting entity and is an integer greater than one.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Lewis. In particular, Lewis teaches that each steering vector includes T elements having same magnitude but different phases, where T is the number of transmit antennas at the transmitting entity and is an integer greater than one (see paragraph 4, lines 11+, plurality of antennas are weighted and given phase differences for each steering vector).

In view of the above, having the method of Wallace and Trikkonen, then given the well-established teaching of Lewis, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the method of Wallace and Trikkonen as taught by Lewis, since Lewis stated in paragraph 6 that location based services can be provided.

Regarding claim 18, Wallace and Trikkonen do not explicitly teach that each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the PDU and is an integer greater than one.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Lewis. In particular, Lewis teaches that each steering vector includes T elements having

same magnitude but different phases, where T is the number of antennas used to transmit the PDU and is an integer greater than one (see paragraph 4, lines 11+, plurality of antennas are weighted and given phase differences for each steering vector).

In view of the above, having the apparatus of Wallace and Trikkonen, then given the well-established teaching of Lewis, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the apparatus of Wallace and Trikkonen as taught by Lewis, since Lewis stated in paragraph 6 that location based services can be provided.

Regarding claim 23, Wallace and Trikkonen do not explicitly teach that each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the PDU and is an integer greater than one.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Lewis. In particular, Lewis teaches that each steering vector includes T elements having same magnitude but different phases, where T is the number of antennas used to transmit the PDU and is an integer greater than one (see paragraph 4, lines 11+, plurality of antennas are weighted and given phase differences for each steering vector).

In view of the above, having the apparatus of Wallace and Trikkonen, then given the well-established teaching of Lewis, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the apparatus of Wallace and Trikkonen as taught by Lewis, since Lewis stated in paragraph 6 that location based services can be provided.

16. Claims 17 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace in view of Trikkonen and Kim as applied to claims 16 and 21 above, and further in view of Ketchum (previously cited US 2003/0108117).

Regarding claim 17, Wallace, Trikkonen and Kim do not explicitly teach that the at least two steering vectors for each subband are known only to a transmitting entity and a receiving entity for the data packet.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Ketchum. In particular, Ketchum teaches that the at least two steering vectors for each subband are known only to a transmitting entity and a receiving entity for the data packet (see paragraph 12, the steering vector known to the transmitting station is sent to the receiving station, therefore the transmitting station and the receiving station both know the steering vectors).

In view of the above, having the apparatus of Wallace, Trikkonen and Kim, then given the well-established teaching of Ketchum, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the apparatus of Wallace, Trikkonen and Kim as taught by Ketchum, since Ketchum stated in paragraph 10 that high throughput can be achieved without individually coding each frequency bin.

Regarding claim 22, Wallace, Trikkonen and Kim does not explicitly teach that the at least two steering vectors for each subband are known only to a transmitting entity and a receiving entity for the data packet.

However, the above-mentioned claimed limitation is well known in the art, as evidenced by Ketchum. In particular, Ketchum teaches that the at least two steering vectors for each subband are known only to a transmitting entity and a receiving entity for the data packet (see paragraph 12, the steering vector known to the transmitting station is sent to the receiving station, therefore the transmitting station and the receiving station both know the steering vectors).

In view of the above, having the apparatus of Wallace, Trikkonen and Kim, then given the well-established teaching of Ketchum, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the apparatus of Wallace, Trikkonen and Kim as taught by Ketchum, since Ketchum stated in paragraph 10 that high throughput can be achieved without individually coding each frequency bin.

Conclusion

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Curtis A. Alia whose telephone number is (571) 270-3116. The examiner can normally be reached on Monday through Friday, 9am-6pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Aung S. Moe can be reached on (571) 272-7314. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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10/8/2010

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